IS 10236-18 (1988): Procedure for Basic Climatic and Durability Tests for Optical Instruments, Part 18: Sealing Test [PGD 22: Educational Instruments and Equipment]

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UDC 681·7 : 620·165·29

Indian Standard

(Reaffirmed 1998)

PROCEDURE FOR BASIC CLIMATIC AND DURABILITY TESTS FOR OPTICAL INSTRUMENTS

PART 18 SEALING TEST

[Ref : Doc : EDC 36 (4538)]
Optical and Mathematical Instruments Sectional Committee, EDC 36; Panel for Basic Climatic and Durability Tests for Optical Instruments

1. Scope — This standard (Part 18) covers the procedure for conducting sealing test for optical instruments.

2. Terminology — For the purpose of this standard the definitions given in IS : 10236 (Part 1) 'Procedure for basic climatic and durability tests for optical instruments: Part 1 General' shall apply.

3. Object — To determine the effectiveness of sealing of an optical instrument by determining the leakage through the same under specified conditions.

4. Initial Observations — The instrument shall be visually examined for any suspected defects which may bring out leakage.

5. Test Equipments

5.1 For sealing test of optical instruments the leakage through them, when filled with dry air at a specified higher pressure, shall be measured. For this purpose an apparatus measuring leakage rate shall be used, whose characteristics are given in **5.1.1** to **5.1.6**. (*See* Appendix A for description of one type of such an apparatus).

5.1.1 It shall be capable of producing and maintaining a steady pressure of 0·175 kg/cm² over and above the normal atmospheric pressure inside the instrument to which it shall be suitably connected.

5.1.2 It shall have arrangement like mercury manometer or precision gauge to indicate the pressure applied to the instrument with an overall accuracy of ±3%.

5.1.3 It shall have another arrangement like oil manometer or a highly sensitive precision gauge in which very low pressure drop due to leakage is calibrated in terms of cubic centimetres per minute to indicate directly the leakage rate with an overall accuracy of ±3%.

5.1.4 To cater for small and large leakages it shall have provision of two separate ranges, one fine 0 to 100 cc/min and another course 0 to 1 000 cc/min, calibrated for an internal air pressure of 0·175 kg/cm² over and above the normal atmospheric pressure.

5.1.5 It shall have provision for a control tap with arrangement either to close the outlet line of the apparatus for checking the leakproofness of the measuring system or to connect the outlet in direct line with the instrument under test for carrying out the leakage rate measurement.

5.1.6 The air used for creating pressure shall be free of impurities like dust or oil particles. Also it shall be, as far as possible, free of humidity. For this purpose arrangement for desiccation of line air and suitable filters shall be required in the apparatus.

6. Test Severities

6.1 The severity indicated by the leakage rate at 0·175/cm² excess internal pressure shall be as specified in the relevant instrument specification. The value may be selected from those given below:

Severity	*Leakage Rate at 0·175 kg/cm² Excess Internal Pressure*	*Type of Instrument*
I	0 cc/min	Hermetically sealed and fully tropicalized
II	Up to 3 cc/min	Semi-tropicalized
III	Up to 10 cc/min	Partially sealed for civilian use

Note — In case of above severities the leakage rate, in cc/min at 0·175 kg/cm² excess internal pressure shall, as far as possible, not be more than 1 percent of the internal empty volume in cc of the instrument.

Adopted 2 December 1988

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7. Test Method

7.1 All instruments meant for leakage rate measurement shall have one tapped hole having a direct access with the internal volume of the instrument. The tapped hole shall have provision for a closing screw, painted red for clear identification. Where the instrument is having more than one separate air tight compartments, each compartment shall be provided with such a tapped hole with closing screw.

7.2 Tapped hole mentioned in **7.1** shall be provided with an adaptor or nozzle which fits well in the tapped hole. On connecting this there shall be no leakage at the joint.

7.3 The adaptor or nozzle fitted on the instrument (*see* **7.2**) shall be connected through rubber tubing to the outlet nozzle of the apparatus measuring leakage rate.

7.4 The control tap (*see* **5.1.5**) shall then be set to the 'Close' position and the pump unit be switched on. Within a few minutes the manometers or gauges of the apparatus will settle to a steady reading. In condition of no leakage the mercury manometer or gauge shall indicate an air pressure of 0·175 kg/cm^2 and the oil manometer or precision gauge shall indicate a leakage rate of 0 cc per minute.

7.5 The setting of the control tap shall now be gradually changed to the 'Open' position connecting it to the inside of the instrument. On the opening of control tap there will be temporarily an excessively high reading on the oil manometer or gauge as rapid flow of air will occur to build up pressure in the instrument under test. Therefore to preserve the precise nature of measuring system the control tap shall be set alternately to the two positions 'Open' and 'Close' for a short duration in order to build up the internal pressure in the instrument in gradual stages. Such alternate opening and closing shall be more in number for a larger internal volume of the instrument under test.

7.6 As soon as the oil manometer/precision gauge settles to a steady reading and remains steady for at least one minute the leakage rate shall first be noted on the coarse scale of 0 to 1 000 cc/min. If less than 100 cc/min the leakage rate shall then be measured on the fine scale of 0 to 100 cc/min.

7.7 The extent of leakage, if any, as measured by the apparatus shall be within the severity limits specified in the relevant instrument specification.

7.8 On completion of leakage measurement the control tap shall be closed and the pump shall be switched off. Releasing adaptor or nozzle from the apparatus, it shall be taken out of the instrument and the tapped hole shall be tightly closed with the help of the closing screw (*see* **7.1**).

7.9 If the instrument is having more than one separate air tight compartments, each compartment shall be tested using the procedure described in **7.2** to **7.8**.

8. Final Measurements

8.1 In general no observations/measurements after the test will be necessary. But if necessary these shall be stated in the relevant instrument specification.

9. Details to be Given in Relevant Instrument Specification

9.1 The relevant instrument specification shall state the following for carrying out this test:

a) Initial observations;
b) Leakage severity;
c) Whether the instrument is having one or more than one air tight compartments;
d) Position of tapped hole(s);
e) Final observations/measurements, if required; and
f) Any deviation from the normal procedure.

APPENDIX A

(*Clause* 5.1)

APPARATUS FOR MEASURING LEAKAGE RATE

A-1. The apparatus measuring leakage rate consists of a low pressure pump, a desiccating unit and a measuring head for measuring the rate of leakage (*see* Fig. 1, 2 and 3).

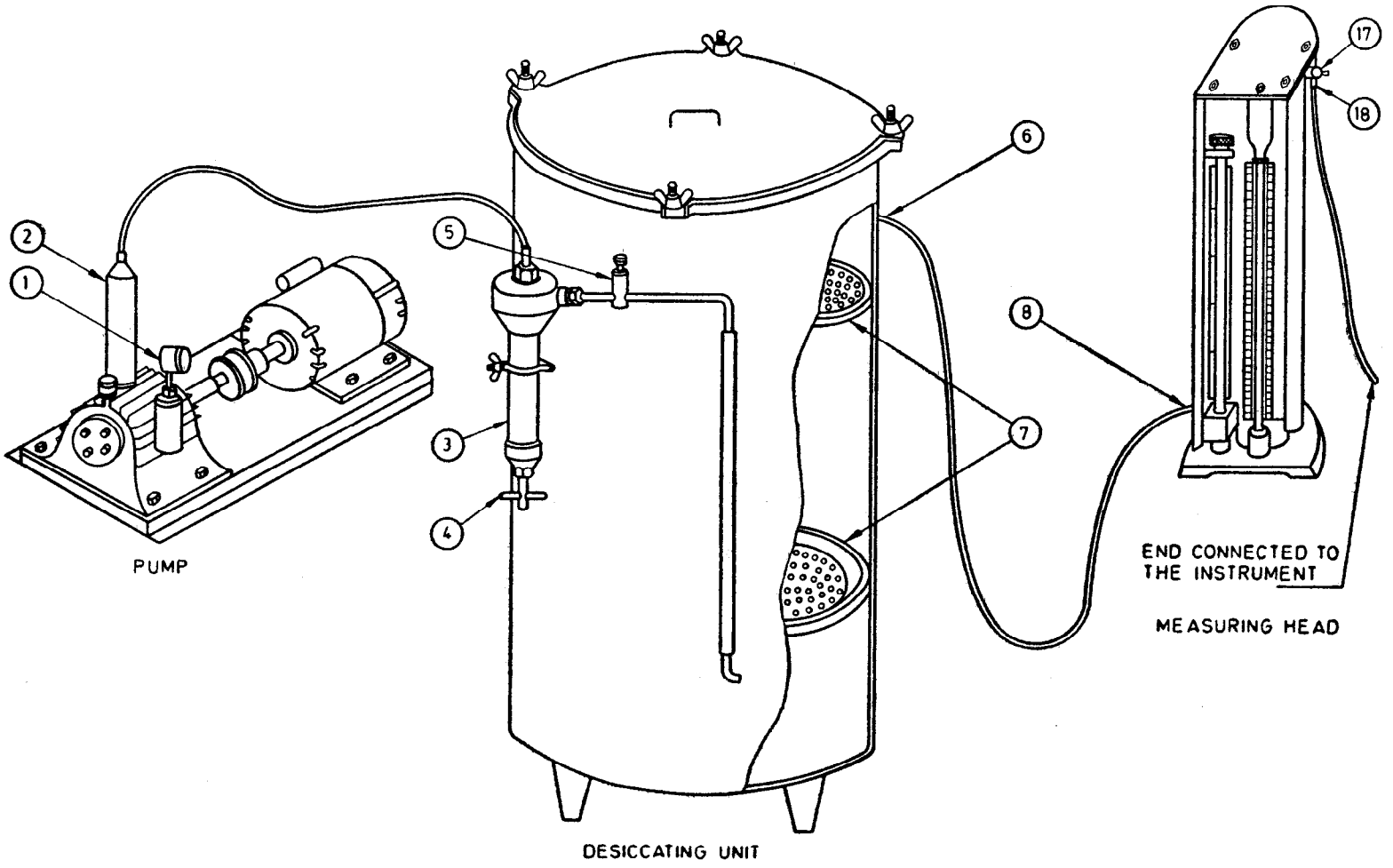

FIG. 1 APPARATUS FOR MEASURING LEAKAGE RATE

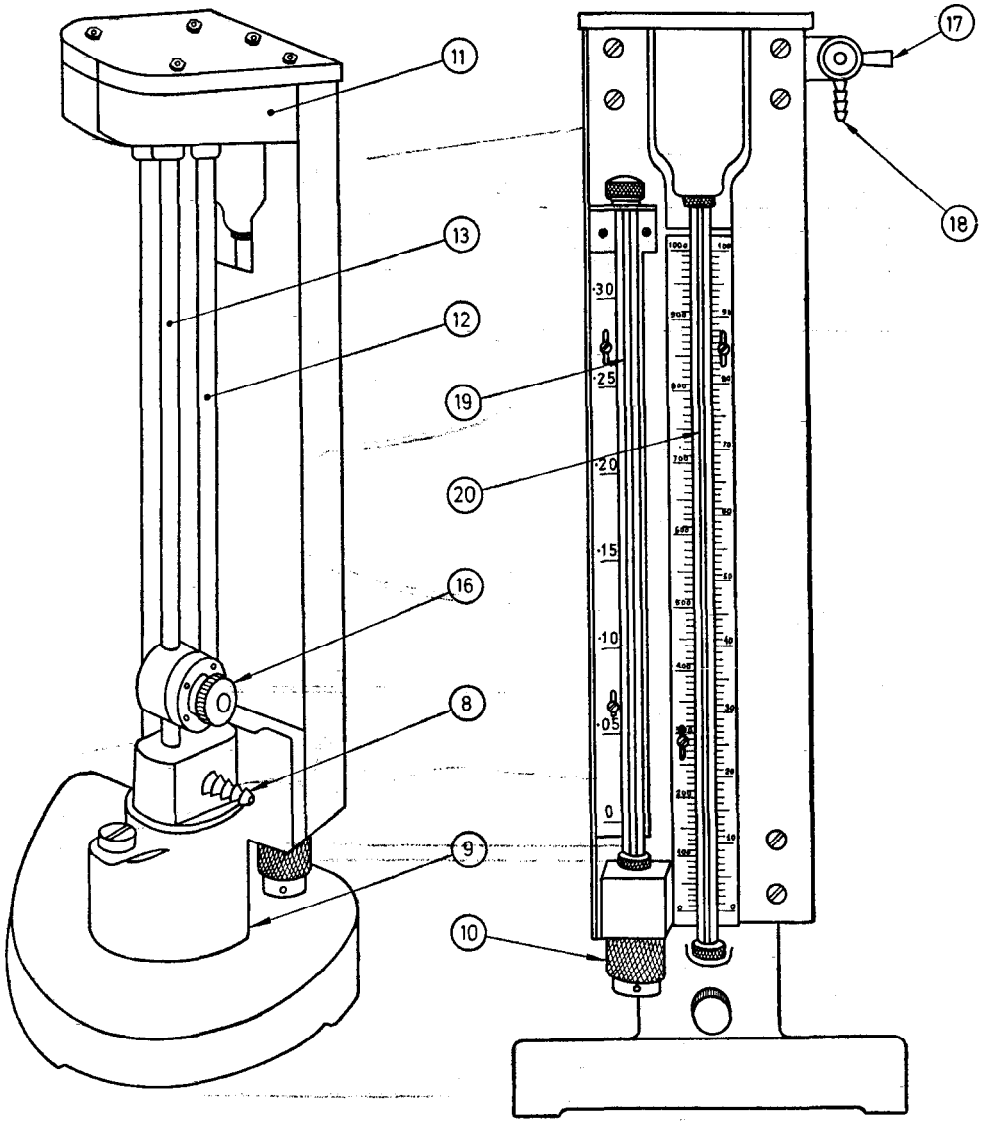

FIG. 2 MEASURING HEAD OF APPARATUS FOR MEASURING LEAKAGE RATE

A-1.1 The pump of the apparatus is provided with a suction filter (1) and a delivery part (2), and supplies filtered air to an air tight desiccating unit. The desiccating unit is provided with a filter unit (3), water and oil return valve (4), pressure relief valve (5) and a delivery nozzle (6). The inside of the desiccating unit is provided with two or more perforated trays (7) containing activated desiccant. The air after passing through the trays gets desiccated and is fed through delivery nozzle (6) to the inlet nozzle (8) of the measuring head.

A-1.2 At the measuring head the compressed air goes to the oil reservoir (9), mercury reservoir (10) and fills up the upper air chamber (11) passing through the tubes (12) and (13) and their fine capillary (14) and course capillary (15) respectively. A scale change valve (16) can be used to close the course capillary leaving only the fine capillary open when the rate of leakage is 100 cc/min or less. The upper air chamber (11) provided with a control tap (17) and an outlet nozzle (18) for connecting the measuring head with the instrument under test. The mercury manometer (19) is marked by a scale, showing pressure of air above atmospheric pressure in kg/cm^2. Using this manometer and pressure relief valve (5) the pressure in the measuring head is regulated at 0·175 kg/cm^2 above atmospheric pressure. The oil manometer (20) is provided with two scales one to read leakage rate 0-100 cc/min and another 0-1 000 cc/min of the instrument under test. These scales are marked for leakage rates of any closed assembly at its internal air pressure of 0·175 kg/cm^2 above atmospheric pressure.

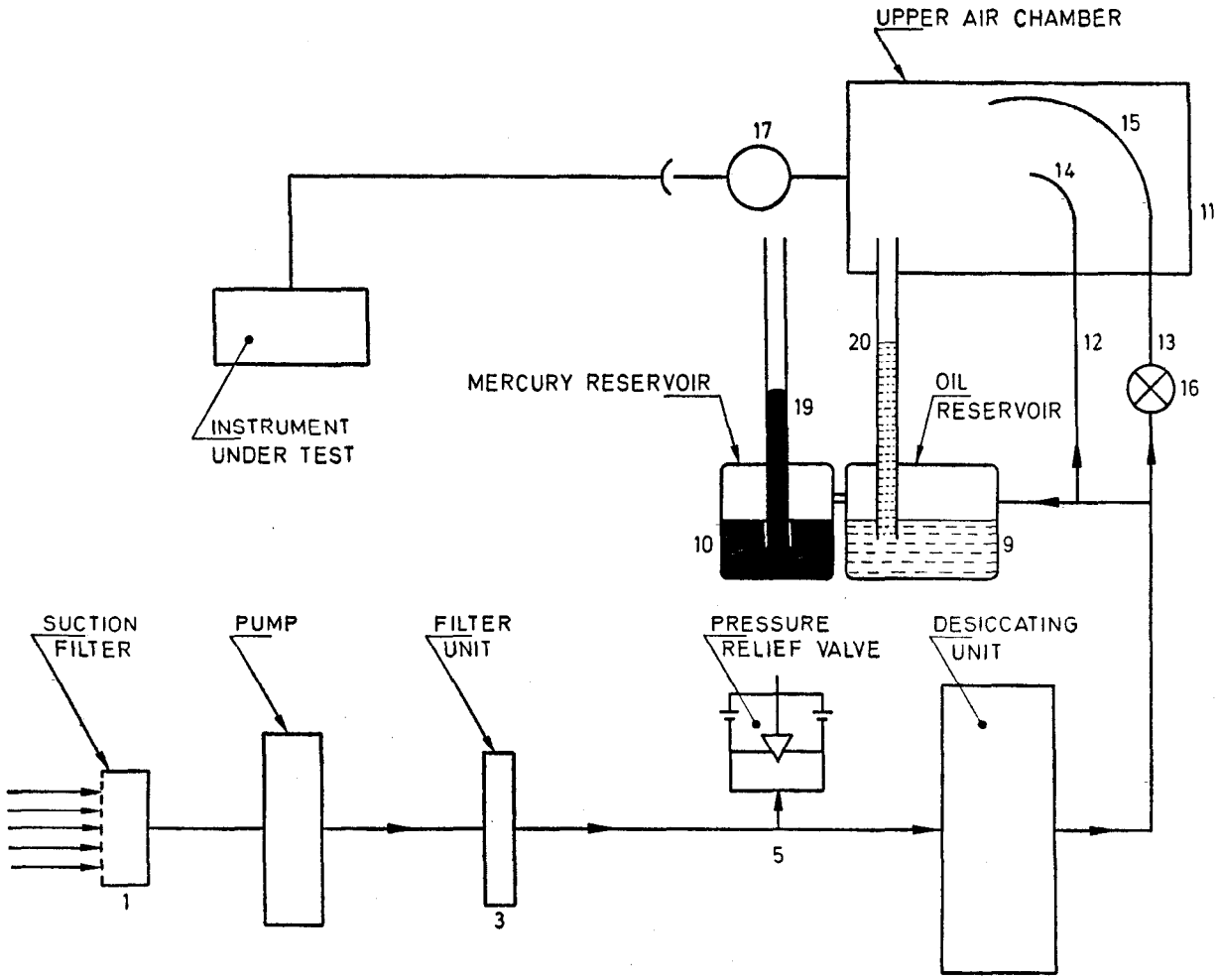

FIG. 3 SCHEMATIC DIAGRAM OF APPARATUS FOR MEASURING LEAKAGE RATE

A-1.3 Initially the air pressure stabilizes at 0·175 kg/cm² in the mercury manometer. If there is no leakage in the instrument under test the oil manometer shows zero reading. In case there is leakage in the instrument there is a continuous loss of air from the upper air chamber (11). Consequently pressure drops in the upper air chamber which is to be filled up through the two capillaries. The pressure drop suffered by the flow of air through the capillaries between their inlet and at the other end in the chamber is proportional to the amount of air flow per minute. This drop can be read by the rise of oil column in the oil manometer. One fine capillary or both the capillaries, fine and course, are used to make up air loss in the upper air chamber depending on the extent of leakage in the instrument under test.

EXPLANATORY NOTE

This standard is one of a series of Indian Standards relating to procedure for basic climatic and durability tests for optical instruments. Fast development in the field of instruments had brought a significant change in their basic content and design. It has been felt over a years that IS : 2352-1963 'Procedure for basic climatic and durability tests for optical instruments' does not cater for the present day needs of the instruments and it is also not in line with the recent trends in climatic and environmental testing procedures to be adopted for meeting their quality and reliability. It has therefore, become necessary to have uniform and more rational testing procedures as far as possible. This series of standards on climatic and durability tests (IS : 10236) has been prepared with this objective. The other standards in this series are as follows:

IS : 10236 Procedure for basic climatic and durability tests for optical instruments:

(Part 1)-1989 General
(Part 2)-1982 Dry heat test
(Part 3)-1982 Cold test
(Part 4)-1982 Damp heat test
(Part 5)-1982 Damp heat (cyclic) test
(Part 6)-1982 Salt mist test
(Part 7)-1983 Mould growth test
(Part 8)-1983 Thermal shock (rapid change of temperature) test
(Part 9)-1983 Low air pressure (altitute) test
(Part 10)-1985 Bump test
(Part 11)-1985 Vibration test
(Part 12)-1985 Shock test
(Part 13)-1986 Dust test
(Part 14)-1986 Driving rain test
(Part 15)-1986 Drop test
(Part 16)-1988 Solar radiation test
(Part 17)-1988 Acceleration (steady state) test

It is proposed to withdraw the existing Indian Standard IS : 2352-1963 as soon as the tests mentioned therein are covered in the new series IS : 10236 are published.

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